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in the affected segments. The remaining 115 segments had normal filling curves and no significant coronary stenosis.

Conclusions: Quantitative CK allows objective detection of regional diastolic dysfunction in patients with CAD and no evidence of regional wall motion abnormality at rest.

1051-139 New Method for On-line Quantitative Analysis of Regional Wall Motion Using Color Kinesis

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Recently, Color Kinesis based on acoustic quantification has been clinically introduced as a new method for objective assessment of LV endocardial wall motion, but current system cannot allow us on-line analysis. In this study, we have newly developed automated segmental motion analysis (ASMA) method and attempted on-line quantitative assessment of LV regional wall motion in 10 normal subjects (N), 5 pts with myocardial infarction (MI), and 3 pts with dilated cardiomyopathy (DCM).

Methods: Parasternal short axis view was obtained for kinetic analysis. Gain controls were adjusted to optimize tracking of the endocardial boundary, and a region of interest surrounding the LV cavity was defined. The LV cross-sectional area was automatically divided into 4 equiangled wedge-shaped sectors. Color pixel counts within each sector were used to calculate regional fractional area changes (FAC). FAC in each sector was expressed as a percent of end-diastolic area, and frame-by-frame changes of FAC in each sector were displayed in real time as bar graph.

Results: In N, uniform FAC between segments were observed in real time. In short axis view of N, end-systolic FAC were 39 ± 12% in IVS, 38 ± 18% in anterolateral, 40 ± 14% in posterior and 48 ± 20% in inferior regions. In contrast, the value of FAC were obviously decreased in infarct-related regions in MI and globally decreased in DCM.

Conclusion: ASMA is a new reliable tool that provides on-line quantification of regional wall motion analysis.

1051-140 Tissue Harmonic Imaging Enables Improved Detection of Left Ventricular Endocardial Border Comparable and Complementary to Contrast Blood Pool Enhancement

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Purpose: Harmonic imaging is a new imaging modality utilizing a nonlinear acoustic response. Our study was designed to compare the information contained in fundamental frequency and 2nd harmonic images of human left ventricle (LV) obtained before and after the i.v. injection of ultrasonic contrast agent, Levovist.

Method: We studied 32 pts using standard apical LV views with 3 harmonic imaging echo systems (Acuson Sequoia, HP Sonos 5500, and ATL 3000). LV was visualized using optimized fundamental image (F), lower frequency (1.66–1.8 MHz transmit, H1) and higher frequency (2.1–2.5 MHz transmit, H2) 2nd harmonic. Quality of endocardial border delineation in 16 standard segments was scored in 0–2 scale by consensus of 2 experienced observers. Scores were averaged to produce an endocardial visualization index (EVI). EVI was also calculated after i.v. Levovist (400 mg/ml, total dose 2.5 g) in the harmonic mode (H + C).

Results: H1, H2 and H + C significantly improved endocardial border detection (ANOVA $P < 0.001$). H1 and H + C outcome was similar. In addition, harmonic modes improved intraobserver reproducibility of LV volume calculation.

	EVI total	EVI basal	EVI middle	EVI apical	# segm. optimal	# segm. subopt.	# segm. invisible
F	1.23 ± 0.39*	1.23 ± 0.79*	1.23 ± 0.81*	1.24 ± 0.65*	222*	187*	103*
H1	1.65 ± 0.40	1.67 ± 0.61	1.67 ± 0.61	1.58 ± 0.64	369	105	38
H2	1.54 ± 0.42	1.57 ± 0.73	1.62 ± 0.64	1.38 ± 0.75#	319#	101#	60#
H + C	1.71 ± 0.32	1.65 ± 0.65	1.73 ± 0.58	1.78 ± 0.47	341	76	31

* $p < 0.05$ vs H1, H2, H2C; # $p < 0.05$ vs H1, H + C

Conclusions: Harmonic LV imaging without contrast enhancement significantly improves the visualization of endocardial border, similarly to imaging with Levovist. Contrast additionally improves the visualization of apex but attenuation hampers the imaging of basal LV segments.

1051-141 Harmonic Versus Fundamental Echocardiographic Imaging for Endocardial Definition

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Harmonic imaging selectively amplifies nonlinear higher frequency reflections, which may improve beam focus and reduce clutter.

Objective: The purpose of this study was to compare harmonic and fundamental (standard imaging at the crystal frequency) echocardiography for endocardial definition.

Methods: The subjects were 51 technically difficult to image pts who underwent two-dimensional echo of the LV in 3 standard views (apical 4-and 2-chamber, and parasternal long axis). Harmonic imaging was performed with either Acuson-SequoiaTissue Harmonics, or ATL HDI 3000 Frequency Conversion Technology. Both harmonic and fundamental images were digitized and displayed in random order as cine loops side-by-side for simultaneous comparison by blinded experienced observers.

Results: Harmonic imaging was graded superior to fundamental imaging for endocardial definition (superior: harmonic = 71.1%, fundamental = 18.7%, similar = 10.2%; $p < 0.001$). Harmonic imaging afforded more consistent superiority over fundamental imaging for the apical 4-chamber view as compared with the apical 2-chamber and parasternal long axis views (harmonics superior: 4-chamber = 90.7%, 2-chamber = 82.2%, parasternal long axis = 76.3%). Additionally, harmonic imaging was superior to fundamental imaging for the apical segments (superior: harmonic = 86.9%, fundamental = 10.6%, similar = 2.5%; $p < 0.001$).

Conclusions: Harmonic imaging improves endocardial definition compared to fundamental imaging, particularly in the apical 4-chamber view.

1051-142 Why Does Tissue Harmonic Imaging Improve Image Quality: A Quantitative Examination Demonstrating Side-Lobe Suppression

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Harmonic imaging exploits the spontaneous generation of higher frequencies as ultrasound propagates to improve image quality, but the quantitative explanation of this improvement is unknown.

Hypothesis: Because harmonics are generated in a nonlinear relation to fundamental signal strength, we hypothesized that side lobe harmonics would be much lower in relation to central beam strength resulting in less clutter in the cavity, improved wall definition, and a higher signal-to-noise ratio (SNR) between cavity and wall.

Methods: Paired examinations (fundamental vs harmonic) were performed on 2 walls and the cavity from each of three windows in systole and diastole for 5 patients. From 100-pixel regions of interest (ROI, total 180) mean intensity and standard deviations were calculated. Additionally an unpaired t-statistic was calculated between wall and cavity to assess overall image SNR.

Results: Values are for pixel intensity (0–255 scale) except SNR:

Variable	Fundamental	Harmonic	p
Wall intensity	35.8	39.0	0.03
Wall std. dev.	9.8	13.0	0.03
Cavity intensity	8.9	3.5	$< 10^{-8}$
Cavity std. dev.	6.0	4.1	< 0.0001
SNR	1.75	2.08	< 0.0001

Conclusions: 1) Harmonic imaging results in a darker cavity and brighter walls, improving contrast; 2) the most prominent cause is a dramatically cleaner cavity, consistent with significant side lobe suppression.

1052 Effects of Hypertension on the Arterial Wall

Monday, March 30, 1998, Noon–2:00 p.m.
Georgia World Congress Center, West Exhibit Hall Level
Presentation Hour: 1:00 p.m.–2:00 p.m.

1052-47 Effect of Ca^{++} Antagonists and ACE Inhibitors on the Elastic Properties of the Aorta in Essential Hypertension: Different Mechanisms of Action

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Background: Although Ca^{++} antagonists and ACE inhibitors are widely used